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The effect of prenatal exposure to 900-MHz electromagnetic field on the 21-old-day rat testicle

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Highlights

- We examined developmental exposure effect of electromagnetic field on rat testicle.
- Prenatal exposure to electromagnetic field adversely affects rat testicle development.
- Lipid peroxidation levels increases prenatal electromagnetic field exposed rats.
- Apoptotic index increases in testicles prenatal electromagnetic field exposed rats.
- DNA oxidation increases in rats exposed to electromagnetic field in the prenatal term.

Abstract

The aim of this study was to investigate the effect of exposure to a 900-MHz electromagnetic field (EMF) in the prenatal term on the 21-old-day rat testicle. Pregnant rats were divided into control (CG) and EMF (EMFG) groups. EMFG was exposed to 900-MHz EMF during days 13–21 of pregnancy. Newborn CG rats were obtained from the CG and newborn EMFG (NEMFG) rats from the EMFG. Testicles were extracted at postnatal day 21. Lipid peroxidation and DNA oxidation levels, apoptotic index and histopathological damage scores were compared. NEMFG rats exhibited irregularities in seminiferous tubule basal membrane and epithelium, immature germ cells in the lumen, and a decreased diameter in seminiferous tubules and thickness of epithelium. Apoptotic index, lipid peroxidation and DNA oxidation were higher in NEMFG rats than in NCG. 21-day-old rat testicles exposed to 900-MHz EMF in the prenatal term may be adversely affected, and this effect persists after birth.

Introduction

Intensive use in daily life of devices with an electromagnetic field (EMF) effect, such as radios, televisions, computers and mobile phones, results in constant exposure to the effect of EMF. The fact that more than 80% of people in many countries use mobile phones has further increased concerns about the effect of EMFs associated with mobile phone use [1]. The effects of mobile phone use during pregnancy on the developing embryo/fetus have also attracted the interest of researchers. However, the kind of effect that EMF has or may have on the embryo and fetus is still the subject of debate.

A significant part of the studies performed maintain that the effect of EMF may affect embryo and fetus development and that this may compromise the normal development of vital organs [2], [3], [4], [5]. Studies have also maintained that follicular capacity can decline in female rats exposed to the effect of EMF from fertilization to the implantation period, and that this may have an adverse impact on females' reproduction potential [6]. All these studies suggest that testis development in male offspring of female rats exposed to the effect of EMF may be also compromised. The reason for this is testis growth beginning in approximately the second week of pregnancy in rats [7], [8], [9]. Studies have shown that the EMF in rats exposed to a low wave frequency (50Hz) EMF during and after pregnancy increases germ cell death and gives rise to a high apoptotic index (AI) by inducing apoptosis in spermatogenic cells [10].

Our scan of the relevant sources revealed no studies of the effect of a 900-MHz EMF applied for 1 h between the 13th and 21st days of the prenatal period on the testes of young rats. The purpose of this study was therefore to investigate the effect of 900-MHz EMF applied during the prenatal period on the testes of 21-day-old rats using histopathological, morphometric and biochemical techniques.

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Study design and animals

This was a randomized, controlled, nonblinded interventional animal study. Animal experiments and procedures were performed in accordance with the Guide for the Care and Use of Laboratory Animals published by the U.S. National Institutes of Health, and was approved by the Karadeniz Technical University (KTU) Medical Faculty Local Animal Ethical Committee. A total of 40 rats were used in the study, 20 pregnant healthy Sprague Dawley females (6–8 weeks old, weighing 180–250 g), and 20 newborn …

Results

Histopathological evaluation from the H&E testicle sections was performed under light microscopy at a magnification of ×400. Normal architecture was seen in seminiferous tubules, Leydig cells in interstitial tissue and cells belonging to spermatogenic series in the NCG testis sections. No pathological finding was encountered in the NCG testes (Fig. 3A). However, non-matured germ cells in the seminiferous tubule lumen (Fig. 3B) and edema in the interstitial space, irregularities in the …

Discussion

GSM-900 is widely used cellular communication system in Europe and the most popular standard for mobile phones in the world [3], [4], [5], [11]. We therefore investigated the effect on the rat pup testis of EMF at a frequency of 900-MHz by keeping that 900-MHz

frequency fixed in the prenatal period. The effect of EMF on the male reproductive system is still the subject of serious controversy. Some studies have reported that EMFs have cytotoxic effects on spermatogonia, increase AI, decelerate …

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